

SUPPLEMENTAL INFORMATION

Fluence Distribution, Heat Transfer Calculations to Estimate Follicular Heating

The treatment is based on the principle of selective photothermolysis¹¹, the foundation of laser treatments for hair, vascular, and pigmented lesions. Upon irradiation with a pulse of light at wavelengths chosen to be absorbed by a target, the target is selectively heated and thermally damaged. Pulse duration is chosen to correspond to thermal relaxation time of the target, or the target and desired portion of surrounding tissue (Altshuler et al., 2001).

The first step is the calculation of spatial distribution of local fluence with the skin tissue using a well established three-dimensional Monte Carlo simulations program, MCML (Wang et al., 1995 and 1997). Skin is modeled to consist of an epidermis, dermis, and a sebaceous gland of 100 microns diameter at a depth of 1 mm on a central axis of a 9 mm diameter circular laser spot. The epidermal and dermal absorption coefficients are chosen as 1.0 cm^{-1} and 0.2 cm^{-1} , respectively. Though the sebaceous follicles and glands don't have inherent optical absorption, the absorption coefficient of the target sebaceous gland is increased by the delivery of the microparticles. The absorption coefficient of the applied suspension is 345 cm^{-1} and if the concentration in the target volume is assumed to be 3% of the concentration of the applied suspension, the absorption coefficient of the target is 10 cm^{-1} . The assumed 3% delivery is lower than 5% assumed in the calculations by Lloyd, et al. (2002).

Monte Carlo modeling of multiple photons from the incident laser beam yielded a 3-dimensional spatial distribution of fluence. The local heat generated within tissue was calculated as a product of the local fluence and absorption coefficient. Heat transfer calculations were performed with a finite difference method taking into account the heat diffusion within tissue as well as surface cooling comprising of surface contact cooling with a plate at 4°C temperature. The incident radiant exposure was chosen as a conservatively low 10 J/cm^2 over a pulse-duration of 30 ms.

REFERENCES

- Altshuler GB, Anderson RR, Manstein D, et al. Extended theory of selective photothermolysis. *Lasers Surg Med.* 2001;29(5):416-32.
- Wang L, Jacques SL, Zheng L. MCML—Monte Carlo modeling of photon transport in multilayered tissues. *Comput Methods Programs Biomed* 1995;47: 131-146.
- Wang L, Jacques SL, Zheng L. CONV—Convolution for responses to a finite diameter photon beam incident on multilayered tissues. *Comput Methods Programs Biomed* 1997;54: 141-150.
- Lloyd JR, Mirkov M. Selective photothermolysis of the sebaceous glands for acne treatment. *Lasers Surg Med.* 2002;31(2):115-20.

SUPPLEMENTAL FIGURES

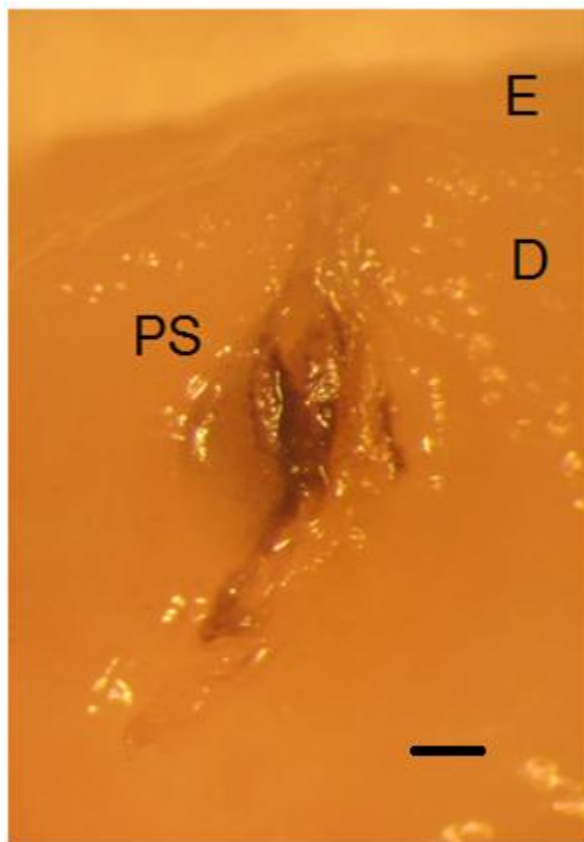


Figure S1. Photograph of vertical cross-sections showing delivery of the light absorbing particles (dark stain) into the follicle in the epilated ex vivo pig ear model. Immediate post-treatment. E: epidermis, D: dermis, PS: pilosebaceous unit. Scale bar = 0.1 mm.

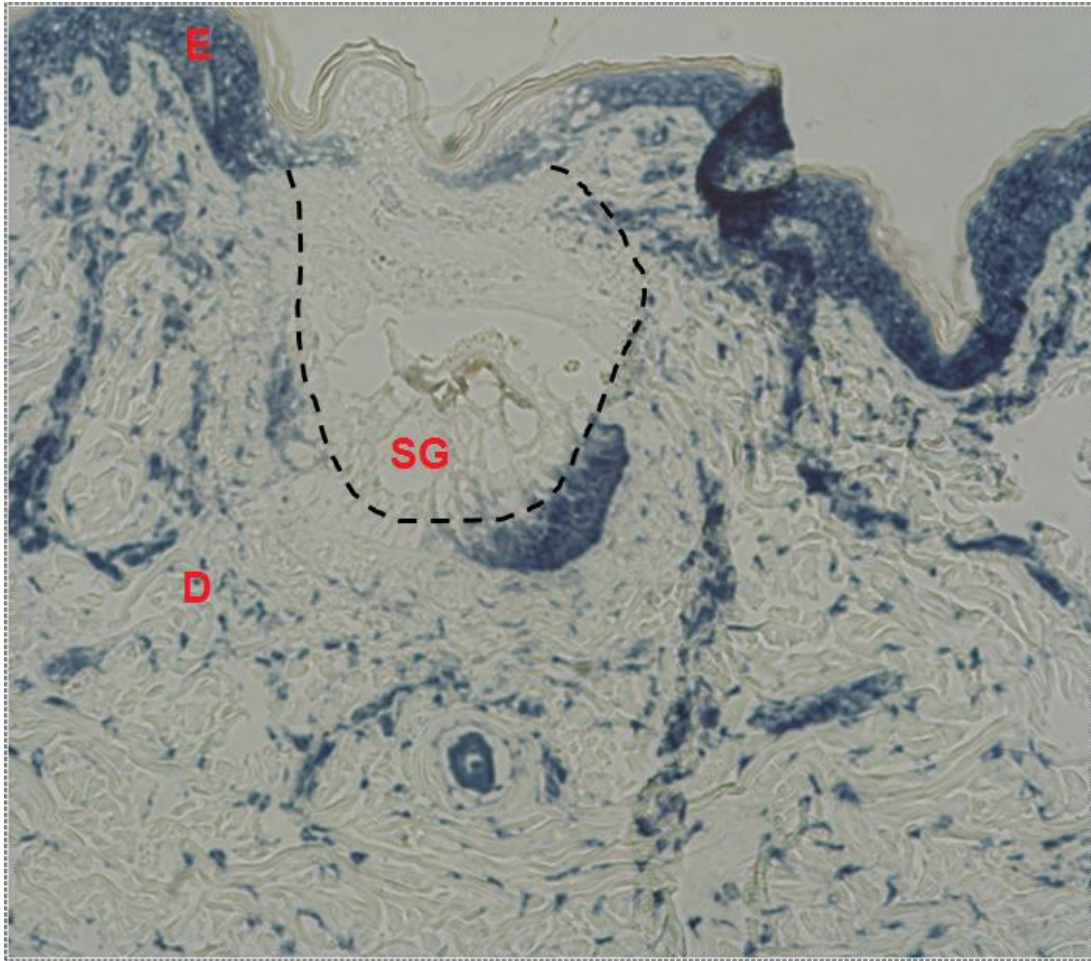


Figure S2. Photograph of NBTC stained section showing lack of LDH staining (outline by the dotted black line) encompassing a follicle and majority of a sebaceous gland in an in vivo pig model, immediately post-treatment. E: epidermis, D: dermis, SG: sebaceous gland.

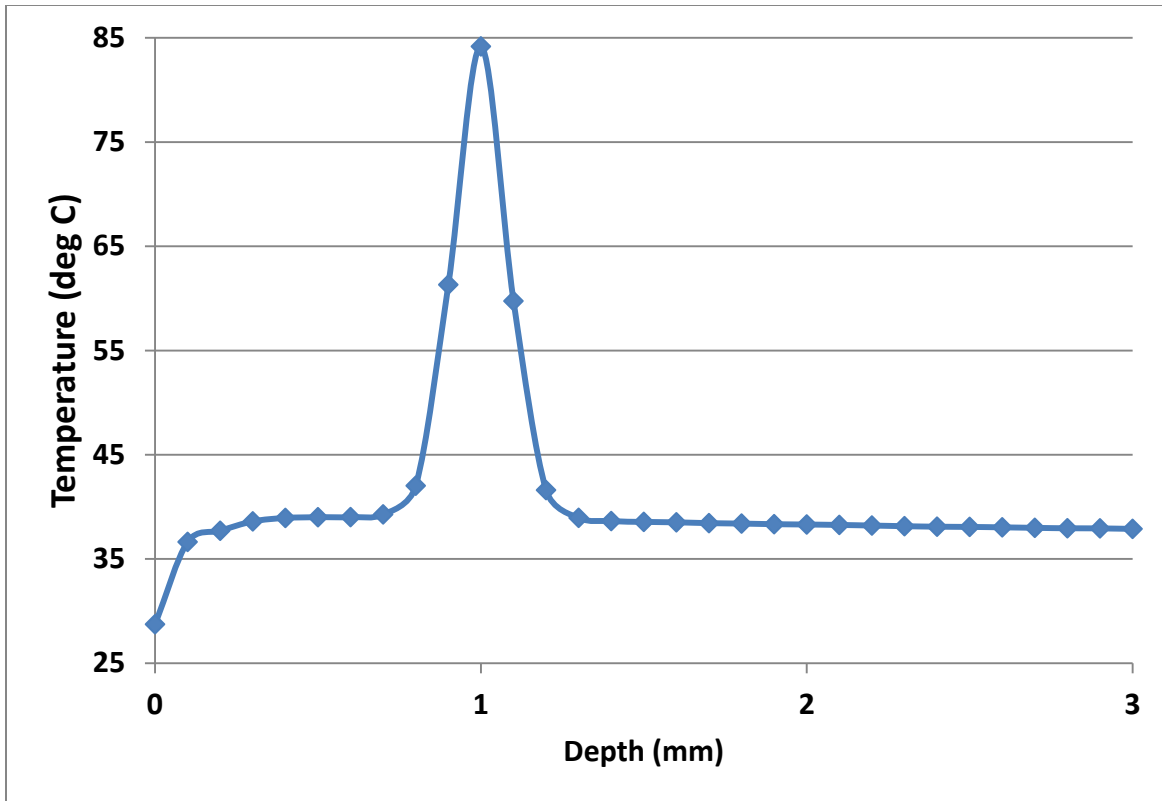


Figure S3. Plot of temperature versus depth at the end of the treatment pulse predicted by the calculations showing localized rise in temperature of the sebaceous gland.



Figure S4. Baseline (top row) and 12-weeks post-baseline (bottom row) photographs of a subject in the treated arm for Trial 2. Subject gave permission to have her de-identified images published.

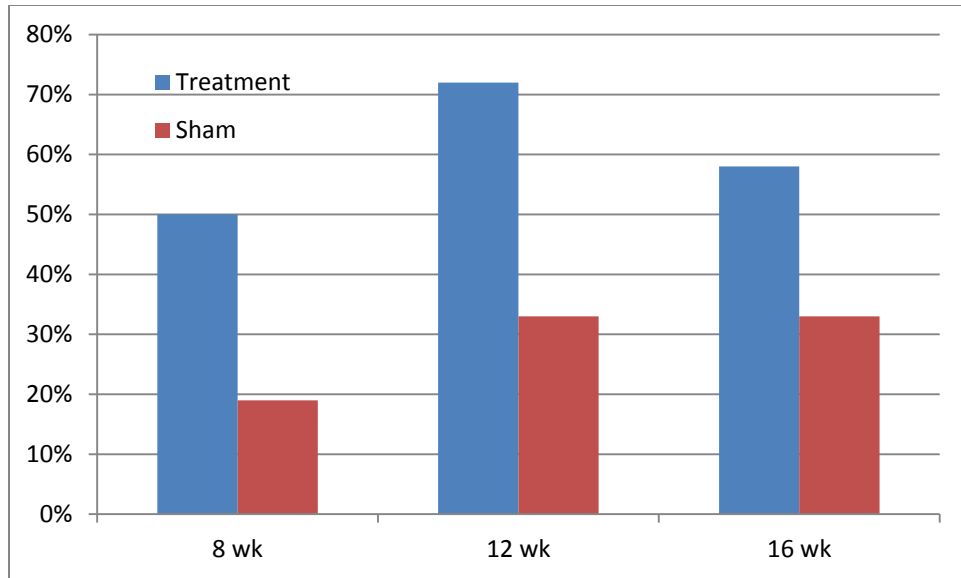


Figure S5. Graph from Trial 2 showing the response rate of treatment-arm and sham-arm in which a positive response was considered as a reduction of 50% or higher in inflammatory lesion count from baseline.